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Patients' perception of their oral and periodontal health and its impact. A cross-sectional study in the NHS.

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Abstract

Aims: To determine patient awareness of periodontal health, dentine hypersensitivity and toothwear, and their impact on oral health quality of life in patients attending NHS practices in South West England.

Method: In this cross-sectional, multi-centre epidemiological study 814 adult NHS patients completed an oral health questionnaire and then underwent a clinical examination. Pocket probing depths (mm), gingival recession (mm), gingival bleeding (yes/no), dentine hypersensitivity (Schiff score, and yes/no) and toothwear (Basic Erosive Wear Examination score) were measured.

Results: Participants were regular dental attenders, with good oral hygiene practices and a low prevalence of periodontal disease (probing depth of 4mm or more) (25%). For all conditions assessed, self-reported data and clinical indices were significantly positively associated, the strongest associations being seen for dentine hypersensitivity and the weakest for toothwear. Periodontal disease and dentine hypersensitivity were significantly associated with all 4 patient reported measures of oral health quality of life studied.

Conclusion: This NHS patient population is well cared for and educated with respect to their oral health. The findings confirm the negative impact of periodontal disease and dentine hypersensitivity, and identifies the need to increase awareness of signs and symptoms of Toothwear.

Key Points:

- The oral health of the cohort of NHS patients in this study was very good and participants were aware of their periodontal condition and of dentine hypersensitivity.
- Both periodontitis and dentine hypersensitivity had a negative effect on quality of life.
- Toothwear is prevalent but inadequately recognised in this population.

Introduction

Periodontal disease in the UK is prevalent with 45% of adults showing some signs of periodontitis in the latest UK Adult Dental Health Survey (ADHS) and 9% showing signs of severe disease.[1] These figures are similar to US and global estimates of prevalence; globally 46% of adults aged 35-44 have at least one tooth with periodontal pocketing of 4mm or more[2] and 11% of adults have severe periodontitis with periodontal pocketing of 6mm or more,[3] while in the US the National Health and Nutrition Examination Surveys (NHANES) between 2009 and 2012 showed that 46% of those aged 30 or more had periodontitis and 8% had severe disease.[4]

Periodontal disease has been shown to be important to sufferers, studies demonstrating that it has a negative impact on the quality of life through its effect on oral function, psychological wellbeing and capacity to cause pain, with evidence suggesting that the impact increases with the severity of disease.[5] Functional affects include difficulties encountered chewing or speaking clearly,[6] while consequences of periodontal disease such as halitosis[7] are associated with negative effects on psychological wellbeing such as being self-conscious and unable to relax.[8] Pain can result from the exposure of root dentine following treatment[9] and in periodontal patients receiving supportive care almost 50% reported pain from dentine sensitivity, this self-reported sensitivity correlated with higher VAS scores following airblast and tactile stimulation of periodontally affected teeth.[10] In addition to the effects that periodontal disease has on the oral cavity there is also now good evidence that it is associated with a large number of systemic diseases.[11]

While there are successful treatments for periodontal disease,[12] it is in the majority of individuals, totally preventable. Microbial biofilms accumulate in areas of the oral cavity where they are less likely to be disturbed by external physical factors such as areas where teeth are crowded[13] or sheltered areas such as the gingival crevice, periodontal pocket and interdental regions.[14] Initially gingivitis characterised by bleeding on brushing or probing occurs, this reversible condition progressing to periodontitis characterised by a loss of tooth supporting alveolar bone, and ultimately to tooth loss in the majority of cases.[15,16] While progress of the disease follows this linear progression in many individuals evidence also exists that indicates in some individuals it progresses in a more random manner, with sites undergo bursts of activity and bone destruction, but may then remain unchanged for periods of time[17]. Gingivitis has been shown to be prevalent in with 54% of UK adults shown to have gingival bleeding in the most recent ADHS.[1] This figure is relatively low however, due to adults improving their personal care and being generally more informed about their oral health. By contrast worldwide the prevalence of gingivitis remains high with gingival bleeding detected in 90 - 100% of individuals.[18]

Given the impact of periodontal disease on quality of life, increasing evidence for its negative effect on general health, and the fact that periodontitis is preventable, and gingivitis reversible, why do rates of periodontal disease remain high?

It is recognised that periodontal disease can be present but painless and with few symptoms,[5] therefore sufferers may not know that they have the condition. Indeed, studies that have compared self-reported gingival bleeding and self-reported periodontal disease with clinically determined gingival bleeding or periodontitis have shown under-reporting on the side of the patient.[19,20] Similar under-reporting has been observed with other oral conditions such as dentine hypersensitivity (DH) where figures obtained by questionnaire were lower than participant response to clinical evaluation.[21] DH arising when dentine is exposed and dentine tubules patent to the pulp[22] is known to be associated with periodontal disease Chabanski et al[23] demonstrating 98% of periodontal patients had sensitivity. However, DH is also linked to healthy gingival recession in patients not susceptible to periodontitis, with 42% of young adults in Europe reporting DH.[21] The increased prevalence of non cervical carious lesions (NCCL) due to the rise in erosive toothwear increases the prevalance of both healthy and periodontally associated recession with 29% of young adults demonstrating a BEWE score of 2 or 3,[24] and 77% of adults showing toothwear exposing dentine in the UK ADHS 2009.[1]

The ability of patients to determine if they have periodontal disease or other oral conditions such as DH or toothwear is important as recognition of the symptoms of the disease enables the individual to seek help/treatment, and if they are able to recognise early stage symptoms they will be able to access treatment sooner with better outcomes. If we as clinicians can understand what patients understand about their oral health we may be able to improve oral hygiene advice and target messages about what to be aware of, what should be treated by a dentist and the consequences of lack of treatment.

The data presented here aimed to determine NHS patients' awareness of various aspects of their oral health and to compare patient reported scores for specific conditions with those measured clinically to see how similar they were. It also examined the association of specific conditions with some indicators of oral health quality of life. This data was collected as part of a larger study that investigated the prevalence of periodontal disease, its association with other oral conditions and potential underlying risk factors the findings of which will be presented separately.

Methods

The study was a cross-sectional, epidemiological, multi-centre study of adult patients attending NHS dental practices that were taking part in the in the Dental Foundation Training Scheme in the South West of England. The study was approved by the HRA and the North West-Preston NHS Research Ethics Committee (IRAS ID: 218303; REC reference 16/NW/0850) and carried out according to the principals of the Declaration of Helsinki following Good Clinical Practice (GCP) guidelines. Data were collected by newly qualified Dental Foundation Trainees (DFTs) who received training in research methods, GCP and the clinical indices that were used in the study. Calibration to ensure consistency of scoring between dentists was undertaken on a training day, trainers and DFTs scoring each of the clinical conditions in adult volunteers who had given written informed

consent. Where there was a variation in the scoring of a particular index between the DFT and trainer, further training was given, and the DFT asked to score the condition in another volunteer. For each dentist training was undertaken until competency in scoring was achieved.

Study participants were patients attending an NHS practice for a routine appointment or check-up with the DFT. Patients that gave written informed consent were enrolled in the study and their eligibility assessed by the DFT. Eligible participants were adults aged 18 or over in good general health with a minimum of 10 teeth. Patients who had used analgesics in the previous 4 hours or required antibiotic cover were excluded from the study.

Enrolled participants were asked to complete the study questionnaire. The study questionnaire was based on one used previously in a European study.[21] It included questions to capture patient reported oral hygiene practices, such as frequency of toothbrushing (number of times/day), attendance at a dentist (number of times/year), use of fluoridated toothpaste (yes/no); questions about patient perception of their oral health (yes/no) such as, 'do you have wobbly teeth, do your gums bleed when you brush your teeth, do you think you have signs of toothwear, have your gums shrunk or receded? Can you can see more of your tooth than you could when you were younger? There were also 4 oral health quality of life questions derived from DHEQ15[25] which participants scored on a 7 point scale from strongly disagree to strongly agree: (1) Having sensations in my teeth takes a lot of the pleasure out of eating and drinking, (2) it takes a long time to finish some foods and drinks because of sensations in my teeth, (3) I have to change the way I eat of drink certain things, (4) I have to be careful how I breathe on a cold day.

Following completion of the questionnaire, the DFT completed a clinical examination of the buccal and lingual surfaces of all teeth except the 3rd molars. Clinical measurements recorded were periodontal pocket probing depths (mm), recession (mm), the presence or absence of gingival bleeding, the presence or absence of exposed dentine, erosive toothwear [Basic Erosive Wear Examination (BEWE)[26] (Table 1)], and DH following an air blast using the examiner scored Schiff index[27] (Table 1) and patient response yes or no. Dental implants, teeth with orthodontic brackets and any with crowns and bridges were excluded.

Statistical Analysis

The data were transferred to SPSS (Version 23) for analysis. The percentage of individuals with a specific clinical condition/ questionnaire response are presented, missing values were excluded. The analyses in Table 2 relate questionnaire variables, which are binary, to logically corresponding clinical indices, which are generally expressed as whole-mouth maximum scores and are ordinal or binary. We report the proportions positive by questionnaire and by clinical examination, with the corresponding sensitivity and specificity. The strength of association is characterised by the generalised Mann-Whitney statistic U/mn which generalises sensitivity and specificity. All these are displayed with 95% confidence intervals. The comparison between

Schiff score and patient-reported DH at tooth level is restricted to participants who declared they had sensitive teeth. Here, no CIs or p-values are calculated due to non-independence. In Table 3, associations are between ordinal variables and are characterised by Spearman's rho.

Results

Data were collected between February and July 2017 at 28 NHS dental practices. The study recruited 814 participants aged 18 to 92 with a relatively even distribution of participants aged 20-29 through to 60-69, and a male:female ratio of 2:3. All 814 participants completed the questionnaire and then underwent a clinical exam.

Clinical assessments demonstrated evidence of periodontitis (pocket probing depths of 4mm or more) in 28% of participants, and 11% had probing depths 6mm or more in at least one site indicating severe periodontal disease. Evidence of bleeding on probing as a marker of inflammation and active periodontal disease was observed in 76% of participants. Almost 90% of participants showed some evidence of gingival recession and clinically relevant recession described as 4mm or more affected 27% of participants. Minimal toothwear (maximum BEWE score 1) was detected in 24% of participants, 54% of participants had at least one BEWE score of 2 (clinically relevant toothwear) and 20% of participants had a maximum BEWE score of 3 (severe toothwear). There was a 98% agreement between having a Schiff score of 1 or more and claiming to have DH. Some DH (Schiff score 1) was seen in 33% of participants while clinically relevant DH scores (Schiff 2 or 3), were recorded in 24% of participants, with scores of 3 most frequently seen in the premolar and first molar regions in the both arches, and on the incisors in the lower arch. Dentine exposure was observed in 75% of participants on at least one tooth.

Participant reported oral health assessed by questionnaire demonstrated that the majority of participants rated their oral health as good, very good or excellent (72%), with only 5% rating their oral health as poor. Oral hygiene practices were generally good with the majority of participants (82%) brushing at least twice daily, 17% brushing once a day and only 1% brushing less than once daily. Participants were also regular dental attenders, 87% having visited the dentist within the past year and 95% within the past 2 years.

Participant responses to more specific aspects of their oral health are shown in Figure 1. When asked about gingival bleeding 29% of participants indicated their gums bled, 44% of whom had used home treatments for bleeding gums and 66% of whom had spoken to their dentist about their bleeding gums. Wobbly teeth were reported by 9% of participants, and 36% of those whom said that this affected eating. 11% of participants indicated they had bad breath, 88% of whom confirmed that this concerned them. Gingival recession was reported by 62% of participants and 54% reported they had toothwear, however a further 29% did not know whether they had toothwear or not. Of those who indicated they had toothwear, only 14% had tried over the counter toothwear products, however 43% had talked to their dentist about their toothwear. Almost half

of study participants (45%) also reported they had sensitive teeth with 74% having used a home use sensitivity treatment and 67% having previously spoken to their dentist about their sensitive teeth. Teeth identified by participants most frequently as sensitive were the upper right first molar, the upper left first molar, the lower left first molar and the lower incisors.

For each oral condition considered there was overall highly significant evidence for positive agreement between self-reported and clinically determined presence of the condition (Table 2), with $p < 0.001$ in all analyses. However, the degree of patient awareness varied widely between different parameters. A major factor in this was that some conditions, notably bleeding, are grossly underreported by patients whereas gum shrinkage is grossly over-reported. This impacts on both the sensitivity, which expresses their ability to identify that they have the condition, and the specificity, indicating their ability to identify that they do not.

Thus for both probing depth and recession depth, slightly over a quarter of participants had a maximum reading of 4mm or greater. The prevalence of self-reported gum shrinkage was much higher than this, 62.1%, whereas only 8.8% of participants said they had wobbly teeth. Accordingly, for subjective gum shrinkage, the sensitivity is high and the specificity is low, but this pattern is reversed for tooth mobility. The degree of difference between the maximum probing depths for those with and without tooth mobility, expressed as U/mn = 0.785, is much higher than in the analysis for gum shrinkage, 0.604.

Three-quarters of participants had bleeding on probing at one or more sites, whereas only 30% claimed to experience bleeding on brushing. Consequently they were better at identifying when they didn't have a bleeding issue (specificity 89.3%) than when they did (sensitivity 35.5%), with a mediocre U/mn of 0.610.

For DH, the proportion of participants who had any Schiff score of 1 or higher, 57.6%, was only moderately higher than the proportion who reported having DH, 45.2%. Consequently they were rather better at identifying when they didn't have DH (specificity 78.4%) than when they did (sensitivity 62.2%). Furthermore, in an analysis at tooth level with a Schiff threshold 2+ based on all teeth from participants who reported sensitivity, there was a similar degree of under-reporting, leading here to a very low sensitivity (24.4%). This and the greatly reduced U/mn indicate that, though they were reasonably aware of whether they had a DH issue, they were much less able to identify which teeth were affected.

Tooth wear was substantially under-reported, with sensitivity and specificity both mediocre at 59% and a relatively weak degree of separation of scores between those who do and do not report wear, U/mn = 0.591.

Participants responses with respect to the impact of their oral health on their quality of life are shown in Figure 2. Oral health had a negative impact on the pleasure of eating and drinking for 27% of participants, 30% reported modifying their eating and drinking behaviour as a result of their oral health, while 17% said that they were slow to eat and drink and 20% altered the way they breathed on a cold day due to problems with their mouths or teeth.

Associations between clinical variables and self-reported indicators of oral health quality of life are shown in Table 3. Greater periodontal pocketing and higher DH scores were associated with poorer oral health quality of life as assessed by all 4 self-reported measures, although the associations, while highly significant were not that strong. Gingival bleeding and recession were less associated with the oral health quality of life measures assessed in this study, but some positive associations were detected; by contrast there were no associations with toothwear.

Discussion

This study recruited 814 adults aged 18 or over attending routine dental appointments at 28 NHS dental practices across the South West of England. This sample size is similar to the number recruited from the general population by mailshot of addresses selected at random in the South West in the latest UK Adult Dental Health Survey (ADHS) carried out in 2009.[28] The ages of the study participants ranged from 18 to 92 years old, and there was a relatively even distribution of participants across the age ranges up to age 70, a distribution in line with UK population data from 2017 which showed approximately similar numbers of individuals at all ages up to 55, followed by a steady decline which was slow to age 65, increasing thereafter.[29]

The findings of the present study demonstrated that participants were regular NHS dental attenders with generally good self- reported oral hygiene practices which were evidence by their relatively low levels of periodontal disease as compared to the prevalence observed in the ADHS 2009.[1] As might be expected in regular dental attenders, participants were aware of conditions affecting their teeth and gums, with significant associations between clinical indices for all oral conditions and the corresponding patient self-reported data. However, the strength of the association varied, patients being most aware of DH, periodontal disease and gingival recession, but being less aware of gingival bleeding and toothwear. While there was good agreement between clinically determined and self-reported DH, the proportion of participants self-reporting DH was 13% lower than the proportion who responded positively following clinical stimulation, a finding that is similar to that reported by West et al[21] and may reflect the fact that DH pain is transient. Participants in the present study also had some ability to identify the teeth that were most commonly sensitive, although the strength of this association was much weaker indicating that it may be difficult for patients to precisely identify which tooth is responsible for the pain. This highlights the need for a clinical assessment of DH as home use treatments are becoming increasingly targeted to individual teeth[30,31] and it is therefore important that the patient can recognise which tooth to treat.

In the present study, there was also good agreement between the proportion of participants who reported mobile or wobbly teeth and the prevalence of severe periodontitis detected clinically. This is probably a result of the cumulative nature of periodontal disease and the regular dental attendance of participants in this study, those with periodontal disease were likely to have been diagnosed by their dentist and advised of the

sequelae of bone loss leading to mobile teeth over time. Periodontal disease was also associated with gingival recession. Similar significant associations between clinically determined periodontitis and self-reported indicators of periodontal disease have been demonstrated previously.[19,20,32] However, in the study by Airila-Månsson[20] where figures were given for prevalence, periodontitis was significantly under-reported by study participants only 1.2% reporting periodontal problems, while 17.1% had pocket probing depth of 5mm or more. Similarly, in the present study, while 25% of participants had pocket probing depths of 4mm or more, only 9% reported wobbly teeth, although clinical experience shows patients do not find mobility of teeth easy to detect unless the tooth is grade III due to the lack of a fixed reference unlike the bodily movement of a tooth when it changes position. A much higher number of individuals (29%) reported bleeding gums indicative of active disease, suggesting they were aware of their periodontal health.

Under-reporting by participants was also observed for gingival recession in the current study, even though there was a relatively strong association between the self-reported and clinically determined data, suggesting that patients were aware of the condition. Nearly two-thirds of participants reported their gums had receded, however 90% of participants had some evidence of recession on clinical examination. This difference is likely to be because recession is not easily visible to the participant in the mirror, that is if they look in a mirror, as it is to the dentist during a clinical exam where lingual and palatal surfaces in particular are easier to view. Similar under reporting has been detected previously in a study where only 16.7% of participants reported an awareness of gingival recession, even though over 60% showed generalised recession and tooth abrasion,[33] a discrepancy that is considerably larger than that found in the present study. Interestingly in the present study, clinically detected gingival recession was also significantly associated with both self-reported wobbly teeth and toothwear, the diversity of the correlations supporting the idea that some of the recession present may be associated with poor oral hygiene and periodontal disease while other areas of recession may be a result of excessive toothbrushing in the quest for excellent oral hygiene which can also result in toothwear.[34]

The difference between self-reported and clinically detected gingival bleeding was the greatest observed in this study, only a third of study participants confirming they had gingival bleeding while the prevalence for clinical bleeding on probing was 75%. As almost half of the participants had used home treatments for bleeding gums and just over half had spoken to their dentist about their bleeding gums participants appeared to be aware that bleeding gums should be treated. Similar findings, where self-reported bleeding of the gums was lower than clinically detected gingival bleeding has been found previously.[19] In both studies the clinical exam was capable of detecting minor bleeding which a participant might not notice, particularly if it was only at the very back of the mouth where participants are not able to see it, or minimal and less obvious when mixed with toothpaste and saliva. In both studies, however, self-reported and clinically detected gingival bleeding were significantly positively correlated but since in the present study the association was less strong

than that observed between self-reported and clinically determined periodontitis, gingival recession and DH, it seems that participant awareness was less for gingival bleeding than these conditions.

In the study reported here participants were least aware of their toothwear, with only a weak albeit significant association observed between self-reported and clinically determined tooth surface loss. This was also the question that yielded the largest number of 'don't know' responses, highlighting that this, of all the conditions is the one that this population of dentally aware, and orally healthy participants were least sure about, even though almost half of them had asked their dentist about toothwear. This lack of awareness of toothwear may reflect the lack of impact toothwear had on quality of life in the present study, toothwear being the only condition not associated with any of the 4 quality of life indicators. This lack of impact on quality of life is indicative that toothwear in the early stages does not cause any problems that are obvious to patients, however, given that toothwear can result in the exposure of dentine and DH[35] and DH was strongly associated with all oral quality of life measures recorded in this study, it is clear that if patients are unaware of their toothwear and allow it to worsen, an impact on their quality of life is likely in the future. Similar to DH, periodontitis was also strongly associated with all 4 quality of life measures, and as both were also the conditions that participants were most aware of, perhaps not surprisingly this suggests that patients are more aware of oral conditions that affect daily activities such as eating and drinking. This data supports previous findings which have shown that both periodontal disease and DH have a negative impact on quality of life.[36,37] Bleeding on probing was associated with 3 and gingival recession 2 of the oral health quality of life measures recorded here, however these associations were not strong, and difficult to rationalise with current knowledge.

The number of participants in the study indicate the strength of the study, however there were some study limitations. While the foundation dentists were excellent at completing paperwork for participants they enrolled in the study, unfortunately accurate information regarding how many participants had been approached is not available, study information was distributed to patients on arrival at the practice and the dentist was not necessarily told how many patients had declined the information. However, there was a good age and gender distribution which was similar to UK population data, however whether the participant population was biased cannot be determined. The data was also collected by a large number of dentists which is hard to avoid when collecting such a large dataset. However, the dentists were all at the same stage of their dental career, having recently qualified and within their first year of dental practice, and they received the same training at the same time thus had exactly the same experience of using the scoring indices. Competence with the indices was tested in a clinical situation with trainers, the study dentists being assessed against the scores generated by the trainers and re-trained where their scores deviated until agreement was reached and the study dentist were confident. In addition, the study dentists were supported in their

practices at the start of the study to ensure they were scoring correctly and completing study paperwork as indicated.

The study could also have asked more oral health quality of life questions, but when designing the study there were concerns about the length of time the questionnaire would take to complete, and that it should not be too daunting for study participants. In interpreting the findings it is important to realise that questionnaire responses about oral conditions and clinical measurements are, unavoidably, not identical, bleeding on brushing and bleeding on probing for example. Also, when patients grossly over- or under-estimate prevalence, it must be recognised that this is relative to the threshold chosen for positivity of the clinical condition, for example whether this is 4mm or 3mm. Nevertheless, while changing the threshold for maximum gingival recession to 3mm+ greatly affects the proportion positive for gingival recession it only slightly affects sensitivity and specificity and cannot affect U/mn.

Taken together the findings from the study reported here demonstrate that the periodontal health, oral health in general, and self-reported oral hygiene practices of these regular NHS dentist attenders was good, and the positive mostly strong associations between self-reported and clinically detected conditions indicates that these patients were educated and aware of their oral health. This is particularly encouraging as this study cohort were NHS patients. However, the study did identify that even in this group, participants were not particularly confident about toothwear, and not able to readily determine if they had it or not. This is an important finding as toothwear is increasing, and the cumulative effects of toothwear over time can negatively impact function, appearance and be responsible for DH in the long term. Dentists need to regularly assess the presence (or absence) of toothwear and if present inform the patients about its aetiology and appearance. GDPs need to focus on prevention of toothwear and patient awareness. Even in this population who were being well looked after, toothwear and the other oral conditions examined were under-reported, emphasising the need for dental professionals to continually try to educate their patients about their teeth and gums and the consequences of failing to look after them.

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Conflict of Interest and Funding Statement

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Table1: Clinical Indices used to measure toothwear and dentine hypersensitivity

[1]Basic Erosive Wear Examination (BEWE)[25], [2]Schiff dentine hypersensitivity score[26]

Measure	Score	Description
BEWE[1]	0	No erosive wear
	1	Initial loss of surface texture
	2	Distinct defect, hard tissue loss less than 50% of surface area
	3	Hard tissue loss greater or equal to 50% of the surface area
Schiff[2]	0	Subject does not respond to air stimulus
	1	Subject responds to air stimulus but does not request discontinuation of stimulus
	2	Subject responds to air stimulus and requests discontinuation of stimulus
	3	Subject responds to air stimulus, considers stimulus to be painful and requests discontinuation of stimulus

Table 2. Associations between clinically detected and patient reported oral health conditions.

Clinical Index**	Questionnaire variable	Clinical prevalence %	% positive on questionnaire	Sensitivity % (95% CI)	Specificity % (95% CI)	U/mn (95% CI)
Probing depth 4mm+	Wobbly teeth	27.6 (24.6, 30.8)	8.8 (7.0, 10.9)	23.1 (18.0, 29.1)	96.7 (94.9, 97.9)	0.785 (0.723, 0.835)
Recession depth 4mm+	Wobbly teeth	26.4 (23.4, 29.5)	8.8 (7.0, 10.9)	20.4 (15.5, 26.3)	95.4 (93.4, 96.8%)	0.734 (0.668, 0.790)
Probing depth 4mm+	Gum shrinkage	27.8 (24.8, 31.0)	62.1 (58.7, 65.4)	77.3 (71.3, 82.3)	43.7 (39.7, 48.0)	0.604 (0.563,0.643)
Recession depth 4mm+	Gum shrinkage	26.8 (23.8, 30.0)	62.1 (58.7, 65.4)	84.0 (78.4, 88.3)	45.9 (41.8, 49.9)	0.693 (0.654,0.729)
Any bleeding on probing	Bleeding on brushing	75.7 (72.6, 78.5)	29.5 (26.4, 32.7)	35.5 (31.8, 39.4)	89.3 (84.2, 92.9)	0.610 (0.567, 0.651)
Any Schiff score 1+	DH	57.6 (54.1, 61.0)	45.2 (41.8, 48.7)	62.6 (58.1, 66.9)	78.4 (73.6, 82.5)	0.740 (0.704,0.773)
Schiff score 2+	Teeth with DH*	*23.4*	*12.9*	*24.4*	*90.6*	*0.623*
BEWE score 2+	Tooth wear	73.6 (70.4, 76.5)	54.2 (50.7, 57.6)	59.0 (54.9, 62.9)	59.2 (52.5, 65.6)	0.591 (0.551, 0.630)

*These analyses are based on 6983 teeth from 360 participants who declared they had sensitive teeth. No p-value or CI can be calculated due to non-independence

Table 3. Associations between clinical conditions and patient reported oral health quality of life questions

Clinical indices		Questionnaire variables			
		No Pleasure in eating or drinking	Slow to finish eating or drinking	Change the way I eat or drink	Change the way I breath on a cold day
Maximum BEWE severity ~~buccal + lingual~~ all surfaces	ρ	-0.024	-0.008	-0.006	-0.036
	p-value	0.502	0.827	0.864	0.312
Maximum Schiff score all sites	ρ	0.141	0.152	0.176	0.148
	p-value	<0.001	<0.001	<0.001	<0.001
Maximum probing depth all sites	ρ	0.167	0.169	0.139	0.100
	p-value	<0.001	<0.001	<0.001	0.005
Maximum recession all sites	ρ	0.088	0.105	0.069	0.047
	p-value	0.014	0.003	0.054	0.191
Whether any bleeding all sites	ρ	0.058	0.108	0.100	0.084
	p-value	0.102	0.002	0.005	0.018

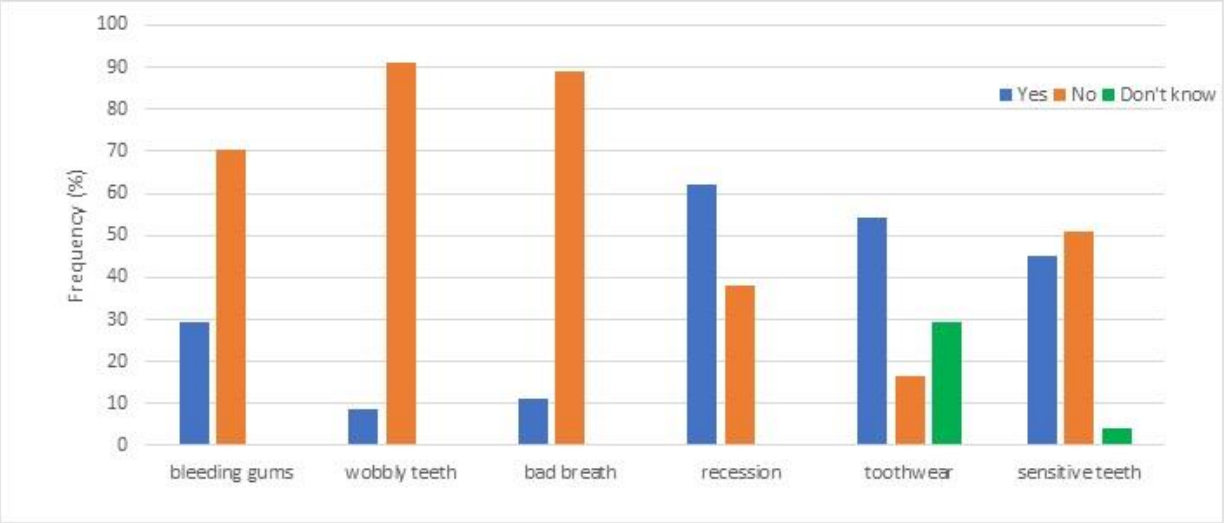

Figure 1 Participants self-reported oral health for specific oral conditions

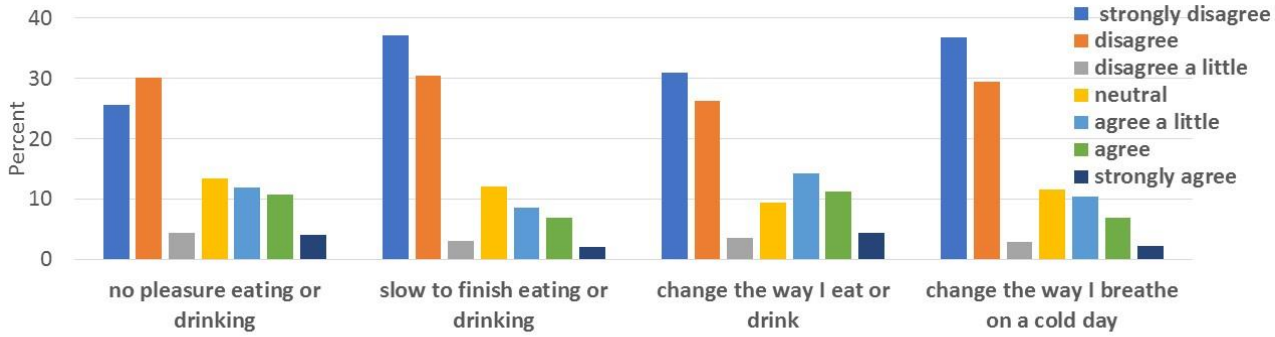

Figure 2 Impact of dentine hypersensitivity on participants self-reported quality of life